

Claims

1. A protective relay for an induction motor, having known operating parameters including known overload thermal current limits, comprising:

a circuit for measuring the input current to the motor;

a first program function for establishing a first thermal threshold value for a start condition of the motor;

means for determining a representation of the thermal condition of the motor during the start condition thereof;

A comparing element for comparing the start condition thermal representation with said first thermal threshold value and for producing an output signal when said first thermal threshold value is exceeded by said start condition thermal representation;

a circuit for establishing a second thermal threshold value for a run condition of the motor, the second thermal threshold value being different from the first thermal threshold value and including a selected time constant which results in time-current curves of the start and run conditions being substantially continuous;

means for determining a representation of the thermal condition of the motor during the run condition thereof; and

a comparator for comparing the run condition thermal representation with said second thermal threshold value and for producing an output signal when said second thermal threshold is exceeded by said run condition thermal representation.

2. A system of claim 1, wherein the time constant can be set by an operator, the time constant provided by the manufacturer, for a particular motor.

3. A system of claim 1, wherein the time constant is:

$$TDR \left[\frac{R_1}{R_o} \cdot I_L^2 (T_a - T_o) \right]$$

where

$$TDR = \frac{1}{\frac{R_1}{R} \cdot 6.25} \cdot \frac{T_a}{T_a - T_o} \cdot \frac{TD}{\ln \left[\frac{6.25}{6.25 \cdot (SF)^2} \right]}$$

and

R_1 = locked rotor electrical resistance

R_o = running rotor electrical resistance

I_L = locked rotor current

T_a = locked rotor time with motor initially at constant temperature

T_o = locked rotor time with motor initially at operating temperature

TD = the time needed to reach trip temperature

SF = service factor (threshold temperature)